The Networks Within Us

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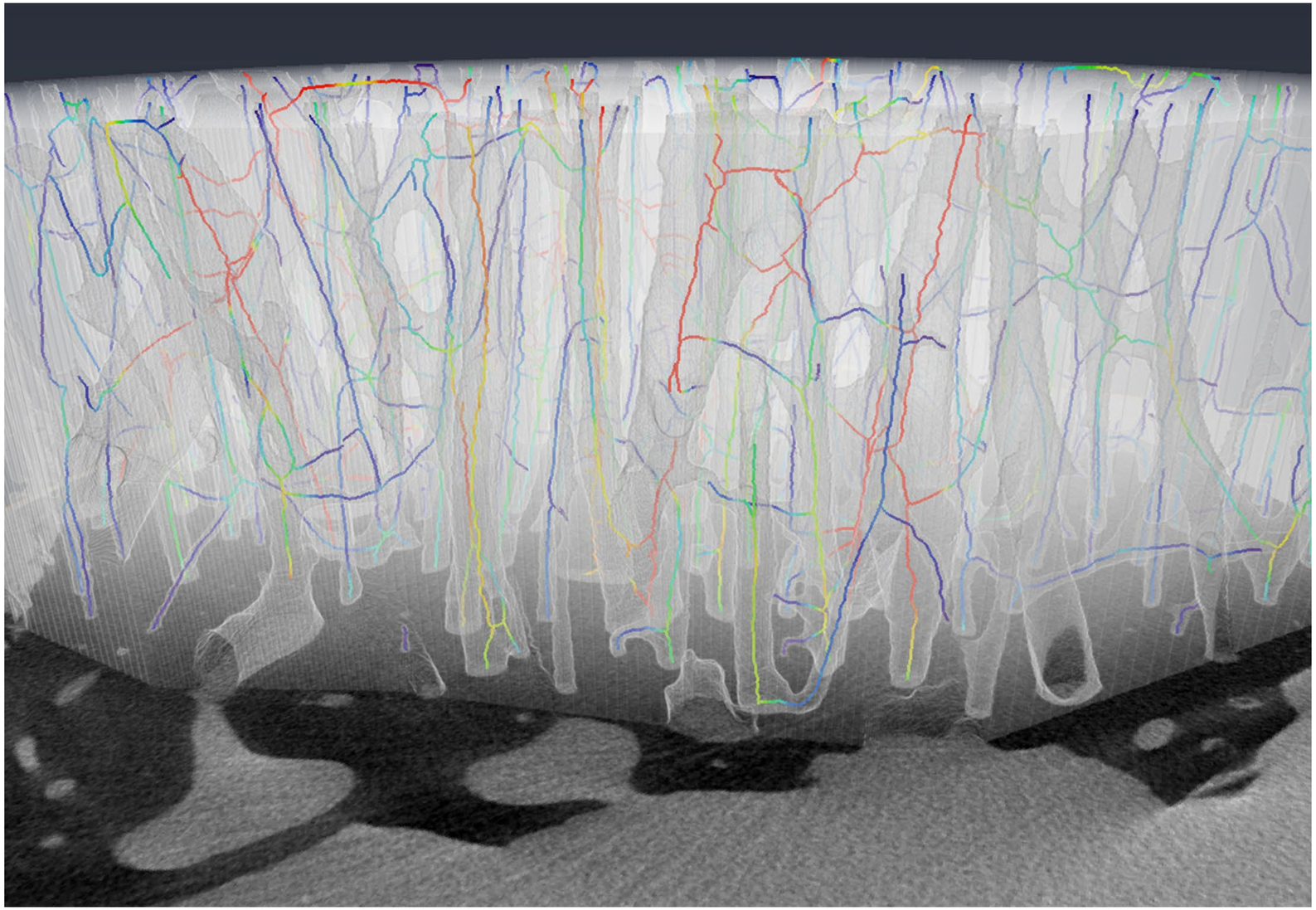

Networks are a fundamental part of the world around us. They exist in tree roots and ant hills, as well as the neural and vascular networks within us. Our vascular networks pass through the densest parts of our skeleton, the cortical bone. These networks provide pathways for nutrients, a vital component in bone growth and repair. My research investigates the effects these porous networks have on the overall strength of bone using 3D analysis. This image is a rendering of the pore network from a human humerus (upper arm bone). CT images are taken at a resolution of about 5 microns per pixel then processed to remove artifacts and isolate the pore network. The canals are colorized in this image based on their thickness: dark blue is the thinnest and red is the thickest. This network can be used to calculate multiple morphological measures such as canal length, diameter, and angle relative to the primary axis of the bone. I simulate the loading of the bone and compare the mechanical response within the structure to the geometry. The goal of this project is to identify how changes in cortical bone porosity affect the fracture risk.